cells of the implanted portions of tumour ceased to proliferate at an earlier period, and were no longer living after the expiration of five days.

In conclusion I must express my indebtedness to Dr. Wakelin Barratt for the assistance he has given throughout the course of this work.

*Summary.*

1. Portions of human carcinoma implanted into animals were observed during the first five days to retain their vitality and to exhibit mitoses after implantation.

2. After the expiration of this period no evidence of vitality was observed.

3. Mitosis was markedly inhibited within 24 hours of implantation, whilst the life of the implanted cells was abolished less rapidly.

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## *On Ceratopora, the Type of a New Family of Alcyonaria.*

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[Plate 6.]

In the introduction to the British Museum Catalogue of the Jurassic Bryozoa (1896), Gregory remarks that, "to the palæontologist, who cannot check his conclusions by the evidence of vascular anatomy or embryology, these tube-dwelling animals are a vexation and a puzzle." This passage has reference to the difficulties that the palæontologist meets in determining the proper systematic position of many fossils that are known to us only by the tubular skeletons that they have left deposited in the rocks. Simple or colonial tubular skeletons, or more correctly shells, may be formed for the protection of recent sedentary animals belonging to the Protozoa, Cœlenterata, Annelida, Polyzoa, and Mollusca, and in many cases the only trustworthy guide to their systematic position is to be found in the study of the soft structures that formed the shell, the shell itself affording no distinctive characters.

In some cases the presence of septa, and in others of tabulæ, may indicate affinities; but even these characters may be misleading and give rise to erroneous conclusions. The presence of septa—now called pseudosepta—

in Heliopora led to the erroneous conclusion that Heliopora was a Zoantharian coral, and the presence of tabulæ in Millepora led to the classification of the Milleporidæ with other tabulate corals. It was not until Moseley examined the soft parts of Heliopora, and until Agassiz examined the soft parts of Millepora, that these corals were assigned to their proper position in the animal kingdom.

However, in the absence of soft parts to assist him, the palæontologist is obliged to base his classification on the skeletal structures, and consequently any new light that can be thrown on the structure and formation of the calcareous tubes of recent corals may be of considerable importance in his attempt to create a natural classification of the extinct forms.

The examination of an interesting dried coral obtained by the naturalists of the American steamer "Blake" has brought to light certain features which are, I believe, unique among tubular corals, and I have ventured to describe them in a separate paper, in the hope that they may be of service in solving some of the difficult problems of the fossil corals.

The single specimen of the species which I propose to call *Ceratopora nicholsonii* was obtained at the "Blake" Station 22, off Cuba, in 100 fathoms of water. Whether it was alive or not at the time of its capture I cannot say, but it was not preserved in spirit, and consequently nothing remains of its soft parts. It is undoubtedly the same species, if it is not actually the same specimen, as that figured by Agassiz in "The Three Cruises of the 'Blake,'" vol. ii, p. 83, but the only passage in the text that refers to it is as follows: "A supposed Favosites is probably a bryozoan genus, growing in the shape of a mushroom, and allied to Heteropora."

The specimen was forwarded to me for examination by Prof. Stanley Gardiner, together with some interesting letters from the late Prof. Alleyne Nicholson, addressed to Sir John Murray, on the subject of its structure.

The specimen consists of a lump of very hard crystalline limestone perforated in various directions by boring sponges, and projecting from the irregular mass of the lump there is a mushroom-shaped process (fig. 1, Plate 6) capped by a thin brown lamina, nearly circular in outline and 42 mm. in diameter, composed of small short vertical tubes. Without going into details, it may be stated that there can be little doubt that the whole lump of coral was formed by the successive growth of the organisms that formed the brown tubes of the cap, notwithstanding the fact that sections of the main substance of the specimen show no trace of tubular structure.

Before describing my own observations on the structure of the brown tubes, I may remark that Nicholson, in his letters to Sir John Murray, pointed out that the specimen differs from Heteropora in the absence of

tabulæ, and in the absence of the pores by which the zooidal tubes are connected in that genus. Whilst hesitating to give any very definite opinion without more thorough investigation, he expressed his belief that the specimen is probably allied to the Helioporidæ.

When the surface of the cap is examined with a magnifying glass, it is seen to be pierced by a number of pores about 0·2 mm. in diameter (fig. 2). These pores are irregular in outline, but all of one kind. It is true there are some pores smaller than the majority, but there is nothing to suggest that the colony was dimorphic, or that anything corresponding with the mesopores of Heteropora were present. When seen in vertical fracture the pores are found to perforate the corallum to a depth of about 1 mm., but instead of being uniform in diameter, as they usually are in tubular corals, they rapidly narrow from above downwards and end abruptly in a blunt conical depression (fig. 3).

Fig. 3.

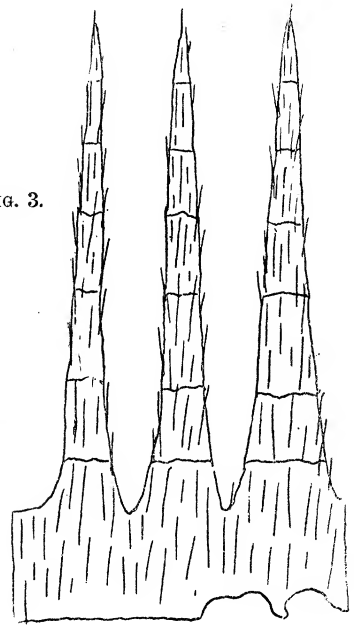

Fig. 4.

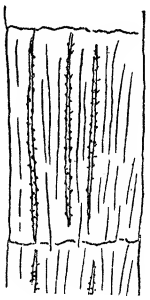

Fig. 5.

Fig. 3.—Diagram to illustrate shape of tubes of Ceratopora with the long needle-like spicules imbedded in the crystalline corallum. The transverse lines probably indicate lines of fracture.

Fig. 4.—Portion of one of the walls showing spicules imbedded in crystalline corallum. More highly magnified.

Fig. 5.—One of the spicules isolated, showing the small tubercles with which it is ornamented.

The tubes do not communicate with one another below the surface, and there are no tabulæ.

The walls of the tubes are brown at the surface, but this brownness gradually fades away, as the walls are traced downwards, into a pure white marble colour. This difference in colour is due, I believe, to a difference in chemical constitution as the walls grow older and thicker.

An examination of the vertical fracture further shows, when it is highly magnified, a number of long and very slender tuberculate spicules, partly imbedded in the walls and partly projecting on the surface and into the cavities of the tubes. All these spicules are arranged vertically, that is to say, parallel with the long axis of the tubes (figs. 3 and 4), and they project upwards into the cavity of the tubes as the latter widen out towards the surface. When a group of two or three tubes are broken off and placed in dilute nitric acid, the free projecting parts of the spicules rapidly dissolve; the lower parts of the walls of the tubes also dissolve in the course of a few hours, but the upper, free, and brown parts of the tubes remain for several days as a soft flexible substance, in which the basal parts of the spicules may be seen until they are dissolved.

My interpretation of this experiment is that the walls of the tubes, as they were formed at the surface, were composed of a horny organic substance, in which a few long spicules of calcium carbonate were imbedded; in the lower and older parts the horny substance became impregnated with calcium carbonate, and finally, at the base, nearly the whole of the horny organic substance became replaced by the inorganic salt.

The method of formation of the crystalline calcium carbonate is not very easy to understand, and, the specimen being unique and of small dimensions, I have not felt justified in making more than a few sections and other preparations. From these, however, I feel satisfied that the construction of this corallum is on very similar lines to that of the corallum of Heliopora as described by Bourne.* There are vertical trabeculæ from which the crystalline rods diverge in three directions, meeting in sutural junctions with similar diverging systems. These vertical trabeculæ can be traced for some distance down into the solid subjacent parts of the cap. There are no dark lines or centres of calcification such as occur in the Madreporaria. On crushing a very small fragment it breaks up into short irregular angular rods, very similar to the fragments of Heliopora drawn by Bourne in his fig. 24. From the consideration of these observations it seems quite probable that, as in Heliopora, the corallum of Ceratopora is formed by "crystallisation of carbonate of lime in an organic matrix."

* 'Quart. Journ. Micr. Sci.,' 1899, vol. 41, p. 499.

From the evidence afforded by one of his letters, Nicholson appears to have noticed the spicules, but he considered them to be adventitious. If they are adventitious they belong to an Alcyonarian or possibly to a sponge that is unknown. No such spicules as these have yet been described. The arrangement of the spicules and their distribution in the walls of the tubes, however, give no support to the view that they are adventitious. If they were adventitious in the sense that the siliceous spicules of Polytrema and other Foraminifera are adventitious, we should expect to find them irregularly arranged and more numerous in some parts of the colony than in others.

If they are the products of the Ceratopora itself, as I believe they are, then we have another and most convincing proof that the genus is not related to Heteropora and the Polyzoa. The presence of tuberculate spicules of calcium carbonate suggests at once that Ceratopora is an Alcyonarian, and if it is true that, at the surface, these long spicules are imbedded in a horny organic substance, the condition is reminiscent of the walls of *Clavularia* (*Hicksonia*) *viridis*, in which long slender tuberculate spicules are associated with a number of horny fibres in the mesoglœa.

The principal difference between the spicules of Ceratopora and those of Hicksonia is one of size. It is difficult to determine the exact length of any one of the spicules of Ceratopora, as the part that is imbedded in the wall is difficult to trace, but their total length cannot be more than 0·3 mm. and their greatest diameter 0·01 mm. The spicules of Hicksonia, on the other hand, are 2·3 mm. in length by 0·18 mm. in diameter. The very small size of the spicules of Ceratopora is correlated with the very small size of the zooids that formed them, and the small size of the zooids may be regarded as one of the principal difficulties that may be felt in accepting the view that Ceratopora is an Alcyonarian.

The following list gives the diameter of the zooids of a few Alcyonaria for comparison with that of Ceratopora:—

| | mm. |
|---|---|
| *Hicksonia viridis* ..... | 3 |
| *Sarcodictyon catenata*..... | 1·5 |
| *Heliopora cærulea* ..... | 0·75 |
| *Xenia novæ britanniæ* ..... | 0·8 |
| *Ceratopora nicholsonii* ..... | 0·2 |

The small size of the tubes of Ceratopora is not a character that, by itself, is sufficient to separate the genus from the Alcyonaria, and, taking into consideration all the other characters, the conclusion must be arrived at that the affinities with the Alcyonaria are more pronounced than with any other group of animals.

If Ceratopora is an Alcyonarian, it is necessary to consider what position it should occupy among the orders of its sub-class.

The long, isolated spicules do not afford a satisfactory character for the determination of its affinities, and although the spicules of one of the Stolonifera have some resemblance in arrangement and shape to the spicules of Ceratopora, this resemblance can be regarded only as an example of convergence. The massive crystalline skeleton in which the spicules are imbedded seems to indicate close affinities with Heliopora, the only recent Alcyonarian in which such a type of skeleton occurs. It is possible, of course, that this type of skeleton may have arisen independently within the sub-class, as we have examples of non-spicular calcareous skeletal structures in the axis of the Gorgonellidæ and in the axis of some of the Pennatulacea among recent Alcyonaria, and possibly also in the thecal walls of Syringopora, Favosites, and the Heliolitidæ among the fossil corals that are supposed to have Alcyonarian affinities.

But this type of skeletal structure, combined with the fusion of the thecal walls to form a honeycomb arrangement of the tubes, may be regarded as sufficient to justify the inclusion of Ceratopora in the order Cœnothecalia, to which Heliopora belongs. Nevertheless, Ceratopora differs from Heliopora in many important respects, and of these the most interesting is the presence of spicules, for in this respect the genus may be regarded as intermediate between the Cœnothecalia and the Stolonifera.

The monomorphic condition of the pores, the absence of tabulæ, and the complete closure of the tubes below by the continuous growth in thickness of the thecal walls, are further characters of importance that separate the two genera. On these grounds Ceratopora must be regarded as the type of a new family of Cœnothecalia, which may be defined as follows:—

*Ceratoporidæ. New Family.*

Cœnothecalia forming a massive skeleton of crystalline calcium carbonate, in which a few slender spicules are imbedded. No tabulæ, the tubes closing below by the continuous growth of the thecal walls. Pores monomorphic and small (in the type species 0·2 mm. in diameter).

*Ceratopora nicholsonii*, new genus and species.—Off Cuba, 100 fathoms.

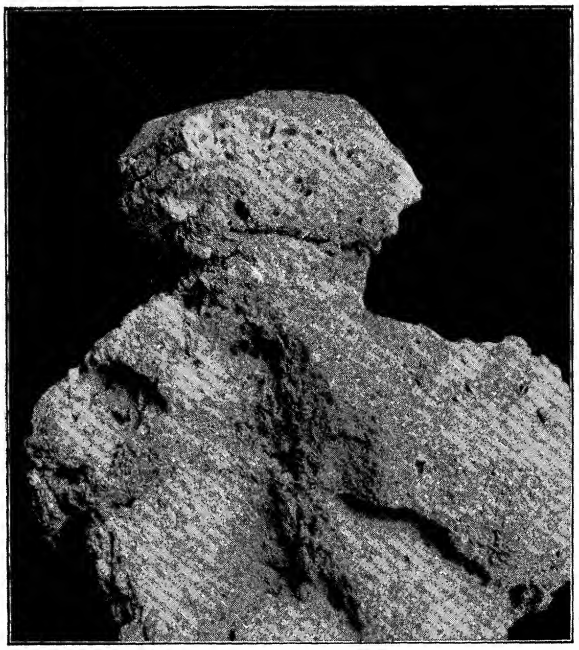

FIG. 1.

*Ceratopora nicholsonii.*—Side view of the mushroom-shaped process capped by the system of short tubes. Nat. size.

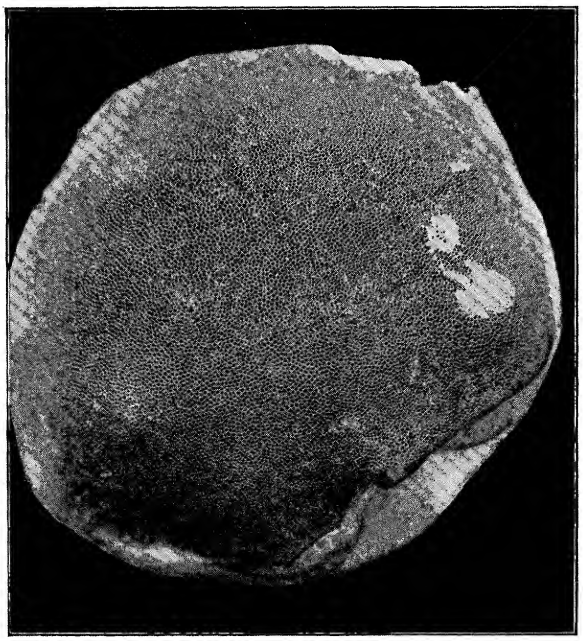

FIG. 2.

Surface view of the cap of Ceratopora, showing the pores. × 2 dias.

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*Ceratopora nicholsonii.*—Side view of the mushroom-shaped process capped by the system of short tubes. Nat. size.

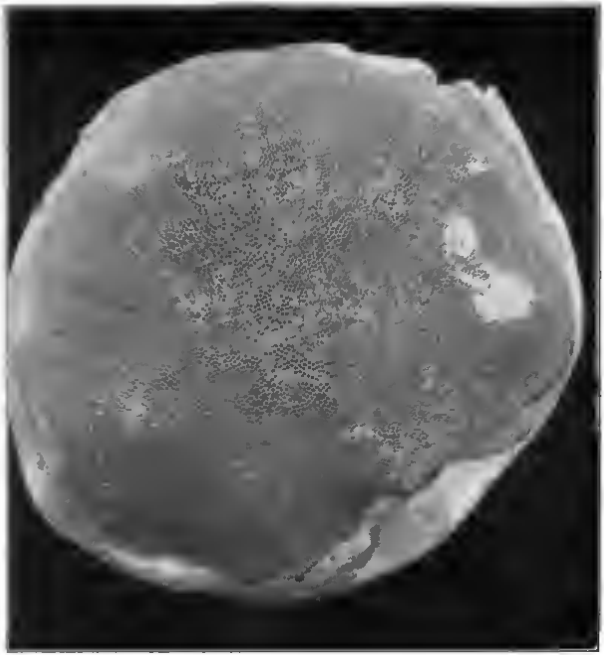

FIG. 2.

Surface view of the cap of Csratopora, showing the pores. × 2 dias.